

**Oracle® Communications
Diameter Signaling Router**

Full Address Based Resolution (FABR) User's Guide

E53470 Revision 01

July 2014

Oracle® Communications Full Address Based Resolution (FABR) User's Guide

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Chapter 1

Introduction

Topics:

- *Overview.....8*
- *Scope and Audience.....8*
- *Documentation Admonishments.....8*
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The *Full Address Based Resolution (FABR) User's Guide* and *Help* provide an overview of FABR functions and of procedures to use to configure FABR. The contents of this chapter include sections on the scope, audience, and organization of the documentation, and how to contact Oracle for assistance.

Overview

The Full Address Based Resolution (FABR) documentation provides information about FABR functions, and how to use the FABR GUI and the following procedures to configure the FABR DSR Application:

- Applications
- Exceptions
- Default Destinations
- Address Resolutions
- System Options

Scope and Audience

The FABR documentation is intended for anyone responsible for configuring and using the Full Address Based Resolution application. Users of this manual must have a working knowledge of telecommunications, of network installations, and of the product that is using the FABR functions.

Documentation Admonishments

Admonishments are icons and text throughout this manual that alert the reader to assure personal safety, to minimize possible service interruptions, and to warn of the potential for equipment damage.

Table 1: Admonishments

Icon	Description
 DANGER	Danger: (This icon and text indicate the possibility of <i>personal injury</i> .)
 WARNING	Warning: (This icon and text indicate the possibility of <i>equipment damage</i> .)
 CAUTION	Caution: (This icon and text indicate the possibility of <i>service interruption</i> .)
 TOPPLE	Topple: (This icon and text indicate the possibility of <i>personal injury and equipment damage</i> .)

Manual Organization

This manual is organized into the following chapters:

- *Introduction* contains general information about the FABR help documentation, the organization of this manual, and how to get technical assistance.
- *Full Address Based Resolution* describes the function of the FABR application.
- *Configuration* describes how to configure the FABR application, including Applications, Exceptions, Default Destinations, Address Resolutions, and System Options.
- *Maintenance* describes maintenance functions and information that can be used with the FABR application.

My Oracle Support (MOS)

MOS (<https://support.oracle.com>) is your initial point of contact for all product support and training needs. A representative at Customer Access Support (CAS) can assist you with MOS registration.

Call the CAS main number at **1-800-223-1711** (toll-free in the US), or call the Oracle Support hotline for your local country from the list at <http://www.oracle.com/us/support/contact/index.html>. When calling, make the selections in the sequence shown below on the Support telephone menu:

1. Select **2** for New Service Request
2. Select **3** for Hardware, Networking and Solaris Operating System Support
3. Select **2** for Non-technical issue

You will be connected to a live agent who can assist you with MOS registration and provide Support Identifiers. Simply mention you are a Tekelec Customer new to MOS.

MOS is available 24 hours a day, 7 days a week, 365 days a year.

Emergency Response

In the event of a critical service situation, emergency response is offered by the Customer Access Support (CAS) main number at **1-800-223-1711** (toll-free in the US), or by calling the Oracle Support hotline for your local country from the list at <http://www.oracle.com/us/support/contact/index.html>. The emergency response provides immediate coverage, automatic escalation, and other features to ensure that the critical situation is resolved as rapidly as possible.

A critical situation is defined as a problem with the installed equipment that severely affects service, traffic, or maintenance capabilities, and requires immediate corrective action. Critical situations affect service and/or system operation resulting in one or several of these situations:

- A total system failure that results in loss of all transaction processing capability
- Significant reduction in system capacity or traffic handling capability
- Loss of the system's ability to perform automatic system reconfiguration
- Inability to restart a processor or the system

- Corruption of system databases that requires service affecting corrective actions
- Loss of access for maintenance or recovery operations
- Loss of the system ability to provide any required critical or major trouble notification

Any other problem severely affecting service, capacity/traffic, billing, and maintenance capabilities may be defined as critical by prior discussion and agreement with Oracle.

Related Publications

For information about additional publications that are related to this document, refer to the *Related Publications Reference* document, which is published as a separate document on the Oracle Technology Network (OTN) site. See [Locate Product Documentation on the Oracle Technology Network Site](#) for more information.

Locate Product Documentation on the Oracle Technology Network Site

Oracle customer documentation is available on the web at the Oracle Technology Network (OTN) site, <http://docs.oracle.com>. You do not have to register to access these documents. Viewing these files requires Adobe Acrobat Reader, which can be downloaded at www.adobe.com.

1. Log into the Oracle Technology Network site at <http://docs.oracle.com>.
2. Under **Applications**, click the link for **Communications**.
The **Oracle Communications Documentation** window opens with Tekelec shown near the top.
3. Click **Oracle Communications Documentation for Tekelec Products**.
4. Navigate to your Product and then the Release Number, and click the **View** link (the **Download** link will retrieve the entire documentation set).
5. To download a file to your location, right-click the PDF link and select **Save Target As**.

Full Address Based Resolution

Topics:

- *Full Address Based Resolution overview.....12*
- *Request Routing with Chained DSR Applications.....13*
- *Request Message Validation.....15*
- *Multiple DSR Application Invocation Prevention.....21*
- *Transaction Metadata Recording for Integrated DIH (IDIH).....22*

This section provides an overview of the function of the Full Address Based Resolution (FABR) application.

Full Address Based Resolution overview

Full Address Based Resolution (FABR) is a DSR enhanced routing application that enables network operators to resolve the designated Diameter server (IMS HSS, LTE HSS, PCRF, OCS, OFCS, and AAA) addresses based on Diameter Application ID, Command Code, Routing Entity Type, and Routing Entity Addresses, and route the Diameter Request to the resolved destination.

The FABR DSR Application validates the ingress Diameter Request message, retrieves the Application ID and Command Code from it, and determines the desired Routing Entity Type to be decoded from the message, based on the configuration. The FABR application extracts the Routing Entity Address from user-configured Attribute-Value Pairs (AVPs) in the ingress message and sends the Routing Entity Address, if extracted successfully, to an off-board DP that is running the Subscriber Database Server (SDS) for destination address resolution.

The resolved Destination address can be any combination of a Realm and Fully Qualified Domain Name (FQDN); Realm-only, FQDN-only, or Realm and FQDN.

FABR will replace the Destination-Host and/or Destination-Realm AVP in the ingress Request message with the corresponding values of the resolved Destination, and forward the message to the Diameter Relay Agent for egress routing into the network.

A Routing Entity can be

- A User Identity:
 - International Mobile Subscriber Identity (IMSI)
 - Mobile Subscriber Integrated Services Digital Network (Number) (MSISDN)
 - IP Multimedia Private Identity (IMPI)
 - IP Multimedia Public Identity (IMPU)
- An IP Address associated with the User Equipment
 - IPv4 (based upon the full 32-bit value in the range of 0x00000000 to 0xFFFFFFFF)
 - IPv6-prefix (1 to 128 bits)
- A general-purpose data type: UNSIGNED16 (16-bit unsigned value)

FABR Functions

FABR provides the following functions:

Routing Based on IMSI/MSISDN Prefix Lookup

If configured, FABR will perform prefix based lookups after the full address lookup is performed. The prefix and range based lookup will only be performed if the full address lookup does not find a match and can be enabled by the operator for a combination of Application-Id, Command-Code and Routing Entity Type.

If a match is found in the prefix database, that FABR application will populate the Destination-Host AVP and/or the Destination-Realm AVP based on configuration settings (similar to the full address lookups).

If a match is not found in the prefix database, then FABR will perform the routing exception handling procedure.

The IMSI/MSISDN Prefix and Range lookup can be enabled or disabled on a system wide basis.

DP Query Bundling

FABR DP Query Bundling enhances the FABR-to-DP interface by supporting the bundling of multiple queries into a single "bundled query" stack event if bundling is enabled.

When "bundled query" is received by the DP, the corresponding "bundled response" will have responses to all the queries that constitute the "bundled query".

Reserved MCC Ranges

Mobile Country Code (MCC) ranges that are reserved for future use are defined in a system-wide **MCC Ranges** table. If the MCC digits portion of decoded IMSI digits fall within one of the ranges designated in the **MCC Ranges** table, the IMSI digits will NOT be used for further Address Resolution. FABR will continue decoding the digits using other AVP instances, or next Priority AVP (if provisioned), or next Routing Entity (if provisioned).

Identifying IMSIs and MSISDNs

Address resolution applications like Full Address Based Resolution (FABR) and Range Based Address Resolution (RBAR) need to categorize User Identities (digit strings) decoded from the Diameter Request AVPs as either MSISDN or IMSI, to allow looking up the User Identity in the appropriate lookup table.

If there is no "+" sign before the digits, the Routing Entity Type is IMPU, and decoded digits falls within MSISDN and IMSI overlap range, configured MCC+MNC combinations can be compared to the first 5 or 6 digits of the User Identity. If a match occurs, the User Identity is considered as an IMSI and used for IMSI lookup. If a match does not occur, the User Identity is considered as a MSISDN and used for MSISDN lookup.

See [Identifying IMSIs and MSISDNs](#) for more information about identifying IMSIs and MSISDNs using digit string lengths and MCC+MNC combinations.

Application Chaining

Application Routing Rules can be configured so that FABR and the DM-IWF applications can both process the same Diameter Request message. See [Request Routing with Chained DSR Applications](#).

Request Routing with Chained DSR Applications

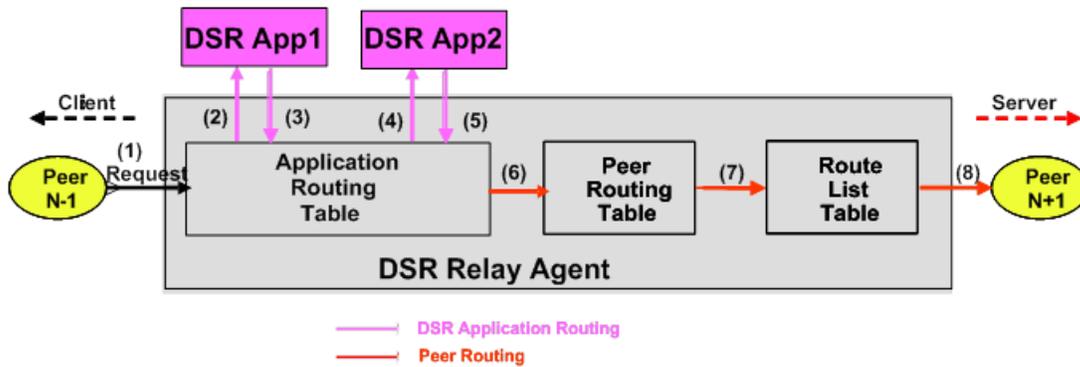
Application Chaining is a method for invoking multiple DSR Applications in sequence on the same DSR.

[Figure 1: Request Processing with Multiple DSR Applications](#) shows an example of Request processing for two DSR Applications executing in sequence. The Application Route Table in this example is executed three times:

1. When the Request enters the system at (1)
2. When DSR Application 1 sends the Request back to the Diameter Routing Function at (3)
3. when DSR Application 2 sends the Request back to the Diameter Routing Function at (5)

At (5) there is no matching Application Routing Rule for the Request, the Request is routed to Peer Route Table processing.

Figure 1: Request Processing with Multiple DSR Applications



- **Application Route Table (ART)**

Application Route Tables are used for routing Request messages to DSR Applications. An ART contains a prioritized list of user-configurable Application Routing Rules. Each Application Routing Rule associates Request message content with a DSR Application.

An ART is searched when a Request message is received from a Peer Node or a DSR Application. Searching an ART when a Request message is received from a DSR Application allows the operator to route the ingress Diameter transaction to multiple DSR Applications in sequence. The operator can create multiple ARTs to assign an ART to a Request message based upon a set of user-defined criteria.

- **Application Routing Rules**

An Application Route Table (ART) consists of a set of prioritized Application Routing Rules that the Diameter Routing Function searches with the content of a Request message, to determine whether the message should be forwarded to a DSR Application for processing.

One ART is searched each time a Request message is received from a Peer Node or a DSR Application. This method allows forwarding a Diameter transaction to one or more DSR Applications for processing.

However, the Diameter Routing Function does not allow a DSR Application to process a Diameter transaction more than once. (The Diameter Routing Function internally keeps track of which DSR Applications have already processed the message.) When the Diameter Routing Function is searching an ART and encounters an Application Routing Rule that is associated with a DSR Application that has already processed the transaction, that Application Routing Rule will be bypassed.

The system always contains a Default ART that cannot be removed using the configuration GUI. The user can create additional ARTs and then define, through configuration, which ART will be searched based on ART precedence selection rules.

Each time that a Request message is received from a Peer Node or DSR Application, the Diameter Routing Function selects an ART to search based on the following ART precedence selection rules (highest to lowest priority):

1. The ART provided by the DSR Application, if it exists (applies only when the Request message was received from a DSR Application)
2. The ART assigned to the ingress Peer Node from which the Request message was received, if it exists
3. The ART assigned to the Diameter Application ID in the Request message header, if it exists

4. The Default ART

The order of DSR Applications which can process an ingress Request message is determined by operator configuration of one or more Application Route Tables.

- Each time the Diameter Routing Function receives a Request message from a Peer Node or DSR Application, it searches the Application Route Tables to determine where to forward the message.
- The highest priority Application Routing Rule matched defines where to forward the message.
- If no Application Routing Rule match is found, the Diameter Routing Function begins Relay Agent routing to an upstream Peer Node.

When FABR and the Diameter-MAP Interworking (DM-IWF) applications run in the same DA-MP, the same Diameter Request message can be processed by both applications.

For a Diameter-to-MAP Request message received from a Diameter Peer that needs to be processed by FABR followed by DM-IWF, two Application Routing Rules are needed; one for routing the message first to FABR and the second one to route the message to DM-IWF after FABR processing is completed

- After the Request is received from the Peer, the Diameter Routing Function searches the Application Routing Rules for the highest priority matching rule. This rule contains the FABR application name, and will result in the Request being routed to FABR.
- FABR processes the message and returns it to the Diameter Routing Function.
- The Diameter Routing Function searches the Application Routing Rules for the highest priority matching rule (excluding all rules that would result in routing of the Request to FABR again). This rule contains the DM-IWF application name, and will result in the Request being routed to DM-IWF.
- DM-IWF processes the message and sends it to an MD-IWF application (SS7-MP).

For a MAP-to-Diameter Request message received by DM-IWF from an MD-IWF application (SS7-MP) that needs to be processed by FABR after DM-IWF processing, a single Application Routing Rule is needed for routing the message to FABR after DM-IWF processing is completed.

- DM-IWF processes the message and sends it to the Diameter Routing Function.
- The Diameter Routing Function searches the Application Routing Rule for the highest priority matching rule (excluding all rules that would cause routing of the Request to DM-IWF again). This rule contains the FABR application name, and will result in the Request being routed to FABR for processing.
- FABR returns the message to the Diameter Routing Function to complete the routing process.

Request Message Validation

The derivation of a user identity address from the ingress Diameter Request message is governed by the rules determined by User Identity Full Address Resolution configuration. The configuration defines the supported Application IDs, the supported Command Codes associated with each Application ID, the preferred User Identity Types to search, and the associated AVPs that contain the User Identity addresses.

The FABR application processes the Diameter Request message based on the configuration, to extract the User Identity addresses.

When FABR receives a Diameter Request message, the following validation is performed:

- First determine whether the Application ID in the message header is defined in the configuration.

- If a valid (configured) Application ID is received in a Diameter Request message, validate whether the pair (Application ID, Command Code) received in the message is defined in the configuration.
- If the pair is configured, select the highest priority User Identity type associated with the pair in the configuration, for User Identity address searching.
- Search for a valid User Identity address from an AVP in the ingress message, based on a prioritized set of AVPs assigned to the triplet (Application ID, Command Code, Routing Entity Type).

If a User Identity address cannot be found in searching the configured User Identity types and AVPs, the appropriate Routing Exception Handling procedure is invoked.

Routing Exception Handling

When an ingress FABR Request message cannot be resolved to a Destination (no address matched, no valid digits decoded, or any other error is returned), FABR will invoke a Routing Exception Handling procedure based on user-defined configuration.

The following Routing Exception Handling procedures are supported:

- Forward the message unchanged
- Forward the message using a user-defined default Destination
- Send an Answer response with a user-defined Result-Code AVP value
- Send an Answer response with user-defined Experimental-Code AVP values
- Abandon Request

The following types of Routing Exceptions will be supported:

- Unknown Application ID
- Unknown Command Code
- No valid Routing Entity addresses were found
- A valid Routing Entity address did not resolve to a configured address
- Blacklisted Subscriber
- DP congestion
- DP errors

Supported AVPs

FABR supports the AVPs associated with the User Identity Types as defined in [Table 2: FABR Supported AVPs](#).

Table 2: FABR Supported AVPs

AVPs	AVP Code	AVP Type	AVP Reference
User-Identity: [Public-Identity] [MSISDN]	700	Grouped	Section 6.3.1 of 3GPP 29.329
MSISDN	701	OctetString	Section 6.3.2 of 3GPP 29.329
Public-Identity	601	UTF8String	Section 6.3.2 of 3GPP 29.229
Service-Information	873	Grouped	Section 7.2.192 of 3GPP 32.299

AVPs	AVP Code	AVP Type	AVP Reference
[Subscription-Id] [...]			
Subscription-Id [Subscription-Id-Type Subscription-Id-Data]	443	Grouped	Section 8.46 of RFC 4006
Subscription-Id-Type	450	Enumerated	Section 8.47 of RFC 4006
Subscription-Id-Data	444	UTF8String	Section 8.47 of RFC 4006
User-Name	1	UTF8String	Section 8.14 of RFC 3588bis
Wildcarded-Public-Identity	634	UTF8String	Section 6.3.35 of 3GPP 29.229
MSISDN	701	OctetString	Section 6.3.2 of 3GPP 29.329
Public Identity	601	UTF8String	Section 6.3.2 of 3GPP 29.229

Each of the configured User Identity types supported in FABR is associated with certain AVPs that contain the User Identity type as defined by various Diameter application standards. [Table 3: Combinations of User Identity Types and Associated AVPs](#) presents all possible combinations of the User Identity types and the associated AVPs.

Table 3: Combinations of User Identity Types and Associated AVPs

User Identity Types	IMSI	MSISDN	IMPI	IMPU
AVPs				
MSISDN		Applicable		Applicable
User-Identity: MSISDN		Applicable		Applicable
Public-Identity	Applicable	Applicable	Applicable	Applicable
User-Identity: Public-Identity	Applicable	Applicable	Applicable	Applicable
User-Name	Applicable		Applicable	
Subscription-ID-Data (0-E.164)		Applicable		Applicable
Service-Information: Subscription-ID-Data (0-E.164)		Applicable		Applicable
Subscription-ID-Data (1-IMSI)	Applicable		Applicable	

User Identity Types	IMSI	MSISDN	IMPI	IMPU
Service-Information: Subscription-ID-Data (1-IMSI)	Applicable		Applicable	
Subscription-ID-Data (2-SIP URI)	Applicable	Applicable	Applicable	Applicable
Service-Information: Subscription-ID-Data (2-SIP URI)	Applicable	Applicable	Applicable	Applicable
Subscription-ID-Data (3-NAI)	Applicable	Applicable	Applicable	Applicable
Service -Information: Subscription-ID-Data (3-NAI)	Applicable	Applicable	Applicable	Applicable
Wildcarded-Public-Identity				Applicable

A User Identity type can be associated with one or more data formats that will be examined when deriving the user identity address from the associated AVPs. The relation between User Identity types and the corresponding data formats to be encountered in the ingress Diameter request message are listed in [Table 4: Relation between Configured User Identity Types and Data Formats](#).

Table 4: Relation between Configured User Identity Types and Data Formats

Configurable User Identity Types	IMSI	MSISDN	IMPI	IMPU
User Identity Formats in Messages				
IMSI Format: ASCII Example: 311480123456789	Applicable		Applicable	
MSISDN Format: ASCII and TBCD Example: 19194605500		Applicable		Applicable
SIP URI with IMSI Format: ASCII	Applicable		Applicable	
Examples: sip:123456789012345@nai.epc.mnc456.mcc123.3gppnetwork.org sip:6311150999995555@ims.mnc015.mcc311.3gppnetwork.org sip:311480999995555@my.network.org sip: 6311480999995555@my.network.org				

Configurable User Identity Types	IMSI	MSISDN	IMPI	IMPU
SIP URI with MSISDN Format: ASCII Examples: sip:+1-919-460-5500@xyz.com;user=phone sip:31148099995555@my.network.org		Applicable		Applicable
SIP URI with NAI Format: ASCII Example: sip:handy.manny@xyz.com			Applicable	Applicable
SIP URI with Wildcarded PSI Format: ASCII Example: sip:WP-A_ServiceType-!.*!@att.com				Applicable
TEL URI with MSISDN FORMAT: ASCII Examples: tel:+1-919-460-5500;phone-context=example.com tel:+19258889999 tel:19195551212		Applicable		Applicable
NAI with IMSI/MSISDN Format: ASCII Examples: 123456789012345@xyz.com 123456789012345 31148099995555@ims.mnc480.mcc311.3gppnetwork.org 631115099995555@xyz.com 631115099995555@ims.mnc015.mcc311.3gppnetwork.org	Applicable	Applicable	Applicable	Applicable
NAI Format: ASCII Example: handy.manny@xyz.com			Applicable	Applicable

Identifying IMSIs and MSISDNs

In certain Diameter messages over the Cx interface (and possibly over the Sh interface), certain AVPs that typically carry an IMSI sometimes can carry an MSISDN.

Address resolution applications like Full Address Based Resolution (FABR) and Range Based Address Resolution (RBAR) need to categorize User Identities (digit strings) decoded from the Diameter Request AVPs as either MSISDN or IMSI, to allow looking up the User Identity in the appropriate lookup table.

Most of the time, these applications can clearly categorize the decoded User Identity based on:

- The configured Routing Entity Type
- The contents of the AVP

For instance, if the User Identity has been decoded from a SIP URI that has a "+" sign before the digits (such as sig:+1-919-460-5500@oracle.com), it can be directly categorized as an MSISDN.

- The number of digits in the User Identity

In certain cases, none of these methods allow a clear categorization (for example, if the number of digits needs to be used and the received number of digits are applicable to both IMSIs and MSISDNs, and thus leads to an ambiguous determination; or if there is no "+" sign before the digits).

if FABR has been configured to decode an IMPU from a User Identity (digit string) but cannot determine whether the user identity is an IMSI or an MSISDN based on digit analysis, a tie-breaker is needed to properly categorize the User Identity.

If the Routing Entity Type is IMPU, the User Identity extracted results in only digits, and the length of the digits in the User Identity falls within an overlap digits range of MSISDN and IMSI (see [Figure 2: IMSI/MSISDN Overlap Range Scenario](#)), the following logic can be used to determine if the User Identity is an IMSI or MSISDN.

- FABR extracts the first 5 or 6 digits of the User Identity and compares them against a list of configured 5- or 6-digit MCC-MNC combinations.

The **Diameter Common > Network Identifiers > MCCMNC** GUI pages can be used to configure up to 2500 distinct combinations of Mobile Country Code (MCC) and Mobile Network Code (MNC). (Refer to the "MCCMNC Configuration" section of the *Diameter Common User's Guide* and Help for procedures to configure MCC-MNC combinations.)

- If a match occurs, the User Identity is considered as an IMSI and used for IMSI lookup.
- If a match does not occur, the User Identity is considered as a MSISDN and used for MSISDN lookup.

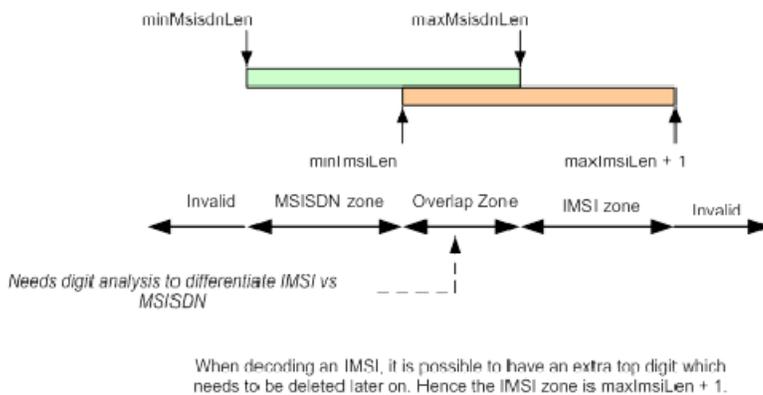


Figure 2: IMSI/MSISDN Overlap Range Scenario

Routing Based on IMSI/MSISDN Prefix Lookup

If configured, FABR will perform prefix-based lookups after the full address lookup is performed. The prefix and range based lookup will only be performed if the full address lookup does not find a match, and can be enabled by the operator for a combination of Application-Id, Command-Code and Routing Entity Type.

If a match is found in the prefix database, that FABR application will populate the Destination-Host AVP and/or the Destination-Realm AVP based on configuration settings (similar to the full address lookups).

If a match is not found in the prefix database, then FABR will perform the routing exception handling procedure.

The IMSI/MSISDN Prefix and Range lookup can be enabled or disabled on a system wide basis.

Multiple DSR Application Invocation Prevention

The DSR provides a mechanism for preventing the same DSR Application from being invoked on two different DSR nodes:

- When a DSR Application does not want to be invoked a second time on another DSR, it can insert a DSR AVP called "DSR-Application-Invoked" containing its DSR Application ID.
- When the Diameter Routing Function searches an ART, it ignores any Application Routing Rules associated with a DSR-Application that has inserted the "DSR-Application-Invoked" AVP

DSR-Application-Invoked AVP

In order to prevent the same DSR Application from being invoked on multiple DSRs in a network (and processing the same message twice by the same DSR Application), a DSR Application can (optionally) add to the Request message a DSR-Application-Invoked AVP containing the DSR Application ID.

Table 5: DSR Application-Invoked AVP

Byte 1	Byte 2	Byte 3	Byte 4
AVP Code = 2468			
Flags=10000000	Length = 16		
Vendor ID = 323			
DSR Application Id = Unsigned32			

This AVP is decoded by the Diameter Routing Function prior to ART processing to prevent multiple invocations of the same DSR Application. Any Application Routing Rule with this DSR Application Id will be ignored by the Diameter Routing Function.

This AVP can be repeated in the Request to indicate different DSR Applications, but will be inserted only once per DSR Application.

Insertion of a DSR Application-Invoked AVP is controlled by DSR Application specific configuration, such as:

Allow Subsequent FABR Invocation - Checked = Yes, Unchecked = No

If checked, subsequent invocation of FABR on a different DSR node in the network is allowed.

Transaction Metadata Recording for Integrated DIH (IDIH)

Integrated DIH (IDIH) can be used to capture detailed information about selected Diameter transactions, and transmit this information to DIH for further analysis.

The Diameter Routing Function and invoked DSR Applications record detailed information about each Diameter transaction - called transaction metadata. Each metadata record describes an important event in the lifetime of a Diameter transaction. Metadata appears in the Trace Transaction Record (TTR) in the order that the metadata-generating events actually occurred. Together, all of the metadata records combine to document the processing performed on the entire transaction, and can later be used to provide diagnostic information when performing troubleshooting. Metadata is recorded to a TTR for each transaction so that, even if the transaction is selected to be sent to DIH at an Answer Troubleshooting Trigger Point (TTP-IA or TTP-EA), the metadata for all of the messages in the transaction will be present.

The functions of IDIH are described in the *Integrated DIH User's Guide* and Help.

FABR will record the Application-specific metadata events described in [Table 6: FABR Metadata-Generating Events](#).

Table 6: FABR Metadata-Generating Events

Event	Type	Scope	Instance Data	When Recorded
Address Resolution Match found	Address Resolution Match	App Data	<ul style="list-style-type: none"> Routing Entity Type (such as "IMSI") Routing Entity AVP (such as "Public-Identity") Routing Entity Address (such as "311480123456789") 	After FABR searches and finds a valid Routing Entity address in an ingress Request message using a prioritized set of AVPs associated with the highest priority Routing Entity Type assigned to the Address Resolution order pair (Diameter Application ID, Command Code).
DP Query Event Sent to DP for processing	DP Query Sent	App Data	<ul style="list-style-type: none"> Routing Entity Data Format (such as "IMSI") Routing Entity Address (such as "123456789012345") 	When FABR sends a DP query event to the DP for Destination address resolution.

Full Address Based Resolution

Event	Type	Scope	Instance Data	When Recorded
			<ul style="list-style-type: none"> Destination Type (such as "IMS-HSS") 	
DP Response Event Received from DP	DP Response Received	App Data	<ul style="list-style-type: none"> DP IP Address Type (such as IPv4) DP IP Address (such as 10.240.55.25) Result Code String (such as "Blacklisted") Destination Realm (such as "xyz.com") Destination FQDN (such as "hss1.hss.xyz.com") 	When FABR receives a response to a previous DP query.
Routing Exception	Routing Exception	App Data	<ul style="list-style-type: none"> Routing Exception Type (such as "DP Congestion") Routing Exception Action (such as "Abandon Request") 	After any Routing Exception is encountered.
DP Query Failure	DP Query Failure	App Data	<ul style="list-style-type: none"> DP IP Address Type (such as IPv4) DP IP Address (such as 10.240.55.25) 	After any DP Query failure other than a response timeout is encountered.
DP Response Timed out	DP Response Timeout	App Data	<ul style="list-style-type: none"> DP IP Address Type (such as IPv4) DP IP Address (such as 10.240.55.25) 	When FABR times out waiting to receive a response from the DP to a previous Destination address resolution query.

Chapter 3

Configuration

Topics:

- *Pre-Configuration Activities.....25*
- *FABR Configuration.....28*
- *Post-Configuration Activities.....44*

This section describes the procedures used to configure the FABR application.

Pre-Configuration Activities

Before FABR configuration can be performed, the following activities need to be performed in the system:

- Verify Server status
- Gather information that is required for Diameter, Diameter Common, and FABR configuration
- Configure Diameter Common components that are required for FABR configuration
- Configure Diameter components that are required for FABR configuration
- Configure SDS DP Remote Servers in ComAgent

Verifying Server status

Use this task to verify Server status prior to FABR configuration.

1. From the active SOAM in a 3-tiered DSR topology, select **Status & Manage > Server**.
2. Verify that for each Server, the **Appl State** field is **Disabled**, and the **DB, Reporting Status**, and **Proc** fields are **Norm**.

Diameter Common Configuration for FABR

The following Diameter Common configuration must be done before FABR configuration can be performed.

Use the explanations and procedures in the Diameter Common configuration help and the *Diameter Common User's Guide* to complete the Diameter Common configuration, including the Diameter Common components needed for use with FABR.

SOAM Diameter Common Configuration

Diameter Common configuration for MCC Ranges Network Identifiers and MP Profile assignment for FABR is done from the SOAM GUI in a 3-tiered DSR topology.

1. MPs

Select **Diameter Common > MPs > Profile Assignments**, and verify that the correct Database MP Profiles have been assigned for FABR DA-MPs shown in the **DA-MP** list. If assignments need to be made or changed, use the **Diameter Common > MPs > Profile Assignments** page to assign the correct MP Profiles.

2. MCC Ranges

Use the **Diameter Common > Network Identifiers > MCC Ranges [Insert]** page to specify up to 10 distinct, non-overlapping **MCC Ranges**.

The following two **MCC Ranges** are reserved by telephony standards and are recommended to be created in addition to other specified ranges:

1. 000-199
2. 800-899

NOAM Diameter Common Configuration

Diameter Common configuration for MCCMNC Network Identifiers for FABR is done from the NOAM GUI in a 3-tiered DSR topology.

1. Use the **Diameter Common > Network Identifiers > MCCMNC [Insert]** page to configure MCCMNC entries.

Diameter Configuration for FABR

The following Diameter configuration must be done before FABR configuration can be performed.

All Diameter configuration for FABR is done from the SOAM GUI in a 3-tiered DSR topology.

Use the explanations and procedures in the Diameter Configuration help and the *Diameter User's Guide* to complete the Diameter configuration, including the Diameter components needed for use with FABR.

1. Application Ids

Diameter Application Ids must be configured prior to making them available for use in a FABR Address Resolution. Use the **Diameter > Configuration > Application Ids [Insert]** page to configure Diameter Application Ids.

The Application Ids that need to be configured depend on the types of Diameter Servers being supported, including HSS, PCRF, OFCS, OCS, and AAA.

2. Command Codes

Diameter Command Codes must be configured prior to using them in a FABR Address Resolution. Use the **Diameter > Configuration > Command Codes [Insert]** page to configure Diameter Command Codes.

Configure any Command Codes that need to be handled by FABR. The Command Codes are associated with the Diameter Applications supported by the Diameter Servers (for example, HSS, PCRF, OCFS, OCS, or AAA) which are the destination of Diameter Requests being routed by FABR. For example, the combination of Application Id = S6a and Command Code = ULR/ULA might be relevant for HSS.

3. Application Route Tables

Either use the default **Application Route Table** (always available), or use the **Diameter > Configuration > Application Route Tables > [Insert]** page to configure one or more **Application Route Tables** in addition to the default. **Application Route Tables** contain **Application Routing Rules** that direct messages to FABR and other DSR Applications.

4. Application Routing Rules

On the **Diameter > Configuration > Application Route Tables** page, select an **Application Route Table Name** and click **View/Edit Rules**.

Use the **Viewing Rules for Application Route Table** page to insert or edit an **Application Routing Rule** with the Application Name set to FABR, so that messages are directed to FABR.

If the FABR application and the DM-IWF application will be "chained" so that both of them can process the same Request message, insert or edit a second Application Routing Rule with the Application Name set to DM-IWF.

Set the Priority in each of the two Application Routing Rules to indicate which application will process the message first (the higher priority processes first).

- Set the **Application Name** to **FABR**.
- In the **Conditions** field, set the **Application-Id Operator** to **Equals** and the **Value** to **4**. For all other Parameters, set the **Operator** to **Always True**.

SDS DP Remote Server Configuration

Use this procedure to configure SDS DP Remote Servers to allow FABR to use SDS for address lookup and resolution.

Remote Servers are configured using the ComAgent Remote Server Configuration GUI. Repeat the steps for each SDS DP in your system.

1. From the active NOAM, select **Communication Agent > Configuration > Remote Servers**.
The **Communication Agent > Configuration > Remote Servers** page is displayed.
 2. Click **Insert**.
The **Communication Agent > Configuration > Remote Servers [Insert]** page is displayed.
 3. Enter a unique **Remote Server Name**.
 4. Enter the **Remote Server IP Address**.
Specify the IP address that can be reached via a server's Internal Management Interface (IMI). The IP address uniquely identifies the Remote Server and provides the means by which Communication Agent can establish transport connections to/from the Remote Server.
 5. For **Remote Server Mode**, select **Server**.
 6. Assign the Remote Server to one of the **Available Local Server Groups**.
 7. Click **Ok**.
The **Communication Agent > Configuration > Remote Servers** is displayed with the new Remote Server now listed.
 8. Select **Communication Agent > Configuration > Connection Groups**
The **Communication Agent > Configuration > Connection Groups** page is displayed.
 9. Select the DPServiceGroup and click **Edit**.
The **Communication Agent > Configuration > Connection Groups [Edit]** page is displayed.
 10. Assign the Remote Server you just created to the DPServiceGroup Connection group.
 11. Click **Ok**.
The **Communication Agent > Configuration > Connection Groups** page is displayed.
 12. Expand the **Servers** assigned to the DPServiceGroup to see that the new Remote Server is now included.
- The operational status of what was provisioned can be verified by using the **Communication Agent > Maintenance** pages.
- Select **Communication Agent > Maintenance > Connection Status** to verify that all remote server connections added are shown as "InService" on all local servers.
 - Select **Communication Agent > Maintenance > Routed Service Status** to verify that the status is "Available" for all local servers that are provisioned to connect.

FABR Configuration

The FABR > Configuration pages allow you to manage FABR application configuration.

FABR configuration typically occurs in the following order:

1. Add Diameter **Applications** to a list of FABR supported Diameter Applications.
2. If necessary, configure **Default Destinations**.
3. If necessary, edit routing **Exceptions**.

Note: If a **Routing Exception Action** of **Forward Unchanged** is configured, configure a **Default Destination**.

4. Configure **Address Resolutions**.
5. If necessary, change the **System Options**.

Applications configuration

The FABR > Configuration > Applications page allows you to access a list of Diameter applications supported by FABR.

From the FABR > Configuration > Applications page, you can:

- Filter the list of supported Diameter applications to display only the desired application(s).
- View a list of supported Diameter applications.
- Insert a supported Diameter application.

Note: When an Application entry is added, Routing Exceptions (**Unknown Command Code, No valid Routing Entity Address, No Address Match**) are automatically inserted with the **Routing Exception Action** value as Forward Unchanged.

- Delete a Diameter application from the list of supported Diameter applications.

Note: When an Application entry is deleted, the associated Routing Exceptions are automatically deleted.

Applications configuration elements

Table 7: Applications Configuration Elements describes the fields on the Applications View, Insert, and Edit pages. Data Input Notes only apply to the Insert and Edit pages; the View page is read-only.

Table 7: Applications Configuration Elements

Field	Description	Data Input Notes
Application ID	Diameter Application ID which can be used by FABR, along with Command Code and Routing Entity Type, to determine Address Resolution for routing Request messages.	Format: Pulldown list Range: Configured Diameter Application IDs

Field	Description	Data Input Notes
Routing Mode (Read only)	Method of routing for Request messages received containing the Diameter Application ID	Format: Disabled pulldown list with a value of Proxy .

Viewing supported Diameter applications

Use this task to view currently configured supported Diameter applications.

Select **FABR > Configuration > Applications**.

The **FABR > Configuration > Applications** page appears.

The Applications page appears with a list of supported Diameter applications. This list of applications can be filtered to display only desired applications. The fields are described in [Applications configuration elements](#).

Inserting a supported Diameter application

Use this task to add a new Diameter application.

Inserting a supported Application automatically adds Routing Exceptions (**Unknown Command Code, No valid Routing Entity Address, No Address Match Found, DP Errors, and DP Congestion**) with the **Routing Exception Action** set to Forward Unchanged.

1. Select **FABR > Configuration > Applications**.

The **FABR > Configuration > Applications** page appears.

2. Click **Insert**.

The **FABR > Configuration > Applications [Insert]** page appears.

3. Click on a Radio button to choose how the Application ID is selected.

- Text box to manually enter an Application ID.
- Drop down list, select the Application ID in the Diameter message.

Note: The Application IDs presented in this list are those created using **Main Menu > Diameter > Configuration > Application Ids**.

4. Note that the **Routing Mode** field is disabled.

5. Perform one of the following actions:

- Click **OK** to save the application and return to the **FABR > Configuration > Applications** page.
- Click **Apply** to save the application and stay on this page.

Note: If field validations succeed after clicking either **OK** or **Apply**, the new Application is saved and an informational message about the automatic addition of the Routing Exceptions appears.

- Click **Cancel** to return to the **FABR > Configuration > Applications** page without saving the changes.

If **OK** or **Apply** is clicked and any of the following conditions exist, an error message appears:

- The **Application ID** is empty; no value was entered or selected
- The **Application ID** is not unique; it already exists in the system

- The entry in any field is not valid (wrong data type or out of the valid range)
- The maximum number of supported Diameter applications (16) is already defined in the system

Editing a supported Diameter application

A supported Diameter Application entry cannot be edited. Selecting a supported Diameter Application, clicking **Edit**, and changing the **Application ID** value results in an error message.

To change a supported Diameter Application entry:

- Use the procedure in [Inserting a supported Diameter application](#) to insert the Diameter Application you want.
- Use the procedure in [Deleting a Diameter application from the list of supported Diameter applications](#) to delete the Diameter Application you do not want.

Deleting a Diameter application from the list of supported Diameter applications

Use this task to delete a Diameter application from the list of supported Diameter applications.

An application cannot be deleted if it is being used by an Address Resolution. Before you perform this task, delete any Address Resolution that uses the Application.

1. Select **FABR > Configuration > Applications**.
The **FABR > Configuration > Applications** page appears.
2. Select the Application you want to delete, then click **Delete**.
A popup window appears.
Note: An error message appears if the Application has already been removed.
3. Perform one of the following actions:
 - Click **OK** to delete the application.
 - Click **Cancel** to cancel the delete function and return to the **FABR > Configuration > Applications** page.

If **OK** is clicked, an error message appears if the following condition exists:

- The Application is in use by an Address Resolution

Exceptions configuration

The **FABR > Configuration > Exceptions** page allows you to specify the routing procedure to invoke when FABR is unable to resolve an address to a Destination for each supported Diameter Application and Routing Exception Type.

There are Routing Exception entries automatically inserted with the **Routing Exception Action** set to Forward Unchanged as the default action for a supported Diameter application entry when that application entry is added.

- **Unknown Command Code**
- **No valid Routing Entity Address**
- **No Address Match Found**
- **DP Errors**

- DP Congestion
- Blacklist

Similarly, these Routing Exceptions that are associated with an application entry are automatically deleted when that application entry is deleted.

From the **FABR > Configuration > Exceptions** page, you can:

- Filter the list of exceptions to display only the desired exceptions.
- View a list of supported Diameter applications and their associated Routing Exception Types and Routing Exception Actions.
- Edit the Routing Exception Action and its associated attributes for a supported Diameter application.

Exceptions configuration elements

[Table 8: Exceptions Configuration Elements](#) describes the fields on the Exceptions View and Edit pages.

Table 8: Exceptions Configuration Elements

Field	Description	Data Input Notes
Application ID (Read only)	Application ID in a Diameter message	N/A
Application Name (Read only)	Name of the application corresponding to the Application ID	N/A
Routing Exception Type (Read only)	The routing exception that prevented address resolution. This field displays one of the following values: <ul style="list-style-type: none"> • Unknown Application ID • Unknown Command Code • No Valid Routing Entity Address • No Address Match Found • DP Errors • DP Congestion • Blacklisted Subscriber 	N/A
Routing Exception Action	Action that FABR takes associated with the Routing Exception Type	Format: Radio buttons Range: <ul style="list-style-type: none"> • Forward Unchanged • Forward to Destination • Send Answer with Result-Code AVP • Send Answer with Experimental-Result AVP • Abandon Request

Field	Description	Data Input Notes
Destination	Destination to where the message is forwarded associated with the Routing Exception Type . This field is enabled when the Routing Exception Action is set to Forward to Destination.	Format: Pulldown list Range: Available user-configured destinations
Result-Code Value	Result code associated with this Routing Exception Type . This field is enabled when the Routing Exception Action is set to either Send Answer with Result-Code AVP or Send Answer with Experimental-Result AVP.	Format: <ul style="list-style-type: none"> • Selection text box; numeric • Selection pulldown list Range: <ul style="list-style-type: none"> • Selection box: 1000–5999 • Selection pulldown list: available Diameter result codes
Vendor-ID	Value returned in the Vendor-ID AVP of the answer message associated with this Routing Exception Type . This field is enabled when the Routing Exception Action is set to Send Answer with Experimental-Result AVP.	Format: Text box; numeric Range: 1–4294967295
Error Message	Value returned in the Error-Message AVP of the answer message. This field is enabled when the Routing Exception Action is set to either Send Answer with Result-Code AVP or Send Answer with Experimental-Result AVP.	Range: 0–64 characters Default: Null string

Viewing Exceptions

Use this task to view currently configured Exceptions.

Select **FABR > Configuration > Exceptions**.

The **FABR > Configuration > Exceptions** page appears. This list of applications and associated Routing Exception information can be filtered to display only desired items.

Editing a Routing Exception

Use this task to edit a Routing Exception.

1. Select **FABR > Configuration > Exceptions**.
The **FABR > Configuration > Exceptions** page appears.
2. Select the Application ID/Name you want to edit, then click **Edit**.
The **FABR > Configuration > Exceptions [Edit]** page appears.

Note: An error message appears if the Application has already been removed.

3. Update the relevant fields.

For more information about each field, see [Exceptions configuration elements](#).

- An error is displayed if "Vendor-ID" is not configured when "Send Answer with Experimental-Result AVP" is selected as a value for "Routing Exception Action".
- An error is displayed if "Destination" is not configured when "Forward to Destination" is selected as a value for "Routing Exception Action".
- An error is displayed if "Result-Code Value" is not configured when "Send Answer with Result-Code AVP" or "Send Answer with Experimental-Result AVP" is selected as a value for "Routing Exception Action".

4. Perform one of the following actions:

- Click **OK** to save the edited exception entry and return to the **FABR > Configuration > Exceptions** page.
- Click **Apply** to save the edited exception entry and stay on this page.
- Click **Cancel** to return to the **FABR > Configuration > Exceptions** page without saving the changes.

Default Destinations configuration

The **FABR > Configuration > Default Destinations** page contains the attributes associated with a Default Destination to which FABR routes a message. FABR uses these attributes to modify the contents of a received message before forwarding the message.

Each Default Destination can be configured with any combination of a Realm and FQDN such as Realm-only, FQDN-only, or Realm and FQDN.

From the **FABR > Configuration > Default Destinations** page, you can:

- Filter the list of Default Destinations to display only the desired destinations.
- View a list of Default Destinations.
- Insert a Default Destination.
- Edit a Default Destination.
- Delete a Default Destination.

Default Destinations configuration elements

[Table 9: Destinations Configuration Elements](#) describes the fields on the Default Destinations View, Insert, and Edit pages.

Table 9: Destinations Configuration Elements

Field	Description	Data Input Notes
Name	Unique name of the Destination If a duplicate Name is entered or the Name is not specified, an error message appears.	Format: Alphanumeric and underscore (_); cannot start with a digit and must contain at

Field	Description	Data Input Notes
		least one alphabetic character Range: 1–32 characters
Realm	Realm of the Default Destination The Realm and Fully Qualified Domain Name cannot both be empty; otherwise, an error message appears.	Format: Text box; Realm is a case-insensitive string consisting of a list of labels separated by dots, where a label may contain letters, digits, dashes ('-') and underscore ('_'). A label must start with a letter, digit or underscore and must end with a letter or digit. Underscores may be used only as the first character. A label must be at most 63 characters long and a Realm must be at most 255 characters long.
Fully Qualified Domain Name	Unique Fully Qualified Domain Name of the Default Destination If a duplicate FQDN is entered, an error message appears. The Fully Qualified Domain Name and Realm cannot both be empty; otherwise, an error message appears.	Range: A valid Realm or FQDN. Either Realm or Fully Qualified Domain Name is required to configure a Destination.

Viewing Default Destinations

Use this task to view currently configured Default Destinations.

Select **FABR > Configuration > Default Destinations**.

The **FABR > Configuration > Default Destinations** page appears. This list of destinations can be filtered to display only desired items.

Inserting a Default Destination

Use this task to add a new Default Destination.

1. Select **FABR > Configuration > Default Destinations**.
The **FABR > Configuration > Default Destinations** page appears.
2. Click **Insert**.
The **FABR > Configuration > Default Destinations [Insert]** page appears.
3. Enter a unique name for the destination in the **Name** field.
4. Enter the realm in the **Realm** field.
5. Enter a unique FQDN in the **Fully Qualified Domain Name** field.

6. Perform one of the following actions:

- Click **OK** to save the destination and return to the **FABR > Configuration > Default Destinations** page.
- Click **Apply** to save the destination and stay on this page.
- Click **Cancel** to return to the **FABR > Configuration > Default Destinations** page without saving the data.

If **OK** or **Apply** is clicked and any of the following conditions exist, an error message appears:

- Both the **Realm** and **Fully Qualified Domain Name** are empty; no value was entered
- The **Name** or **Fully Qualified Domain Name** is not unique; it already exists in the system
- The entry in any field is not valid (wrong data type or out of the valid range)
- The required **Name** is empty
- The number of Default Destinations (128) is already defined in the system

Editing a Default Destination

Use this task to edit a Default Destination.

1. Select **FABR > Configuration > Default Destinations**.

The **FABR > Configuration > Default Destinations** page appears.

2. Select the Destination you want to edit, then click **Edit**.

The **FABR > Configuration > Default Destinations [Edit]** page appears.

Note: An error message appears if the Destination has already been removed.

3. Update the relevant fields.

For more information about each field, see [Default Destinations configuration elements](#).

The **Name** field is read-only and cannot be edited.

4. Perform one of the following actions:

- Click **OK** to save the changes and return to the **FABR > Configuration > Default Destinations** page.
- Click **Apply** to save the changes and stay on this page.
- Click **Cancel** to return to the **FABR > Configuration > Default Destinations** page without saving the changes.

If **OK** or **Apply** is clicked and any of the following conditions exist, an error message appears:

- Both the **Realm** and **Fully Qualified Domain Name** are empty; no value was entered
- The **Fully Qualified Domain Name** is not unique; it already exists in the system
- The entry in any field is not valid (wrong data type or out of the valid range)

Deleting a Default Destination

Use this task to delete a Default Destination. A Default Destination cannot be deleted if it is being used by a Routing Exception. Before this task is performed, delete the association with any Routing Exception either by changing the Routing Exception Action to something other than “Forward To Destination”, or by deleting the Supported Application, thereby deleting the associated Routing Exceptions.

1. Select **FABR > Configuration > Default Destinations**.
The **FABR > Configuration > Default Destinations** page appears.
 2. Select the Default Destination you want to delete, then click **Delete**.
A popup window appears.
 3. Perform one of the following actions:
 - Click **OK** to delete the destination.
 - Click **Cancel** to cancel the delete function and return to the **FABR > Configuration > Default Destinations** page.
- If **OK** is clicked and the following condition exists, an error message appears:
- The Default Destination is in use by a Routing Exception.

Address Resolutions configuration

FABR performs off-board database lookups for user identities decoded from Diameter messages. The **FABR > Configuration > Address Resolutions** page allows you to configure which (and how) user identities are to be decoded from the messages. You can provision combinations of Diameter Application ID, and Command Code (the key that is matched to the messages) and configure the Routing Entity Type(s) to be decoded and a prioritized list of AVPs from which to decode these entity types. An Address Resolution supports up to two prioritized Routing Entity Types for each Application ID and Command Code.

- Primary Routing Entity Type (highest priority)
- Secondary Routing Entity Type (lowest priority)

From the **FABR > Configuration > Address Resolutions** page, you can:

- Filter the list of address resolutions to display only the desired records.
- View a list of address resolutions.
- Insert an address resolution.
- Edit an address resolution.
- Delete an address resolution.

Address Resolutions configuration elements

Table 10: Address Resolutions Configuration Elements describes the fields on the Address Resolutions View, Insert, and Edit pages. Data Input Notes only apply to the Insert and Edit pages; the View page is read-only.

Table 10: Address Resolutions Configuration Elements

Field	Description	Data Input Notes
Application ID	Application ID in a Diameter message. The Application ID is an IANA-assigned Diameter Application ID, which is a 32-bit field that is mandatory in all Diameter messages. It is	Format: Pulldown list Range: Application IDs configured for FABR

Field	Description	Data Input Notes
	commonly used for screening and routing messages between Diameter nodes. If a combination of the Application ID and Command Code already exists, an error message appears.	
Command Code	Command Code in a Diameter message If a combination of the Application ID and Command Code already exists, an error message appears.	Format: Pulldown list Range: Command Codes configured for Diameter
Primary Routing Entity and Secondary Routing Entity sections		
Routing Entity	Routing Entity type. The same Routing Entity Type cannot be selected for both the Primary and the Secondary Routing Entity; if the same type is selected, an error message appears. If the Routing Entity Type is not specified for the Primary Routing Entity, an error message appears.	Format: Pulldown list Range: <ul style="list-style-type: none"> • IMSI • MSISDN • IMPI • IMPU
Primary AVP	Primary AVP used for extracting the Routing Entity address. The same Primary AVP and Secondary AVP cannot be selected for either the Primary Routing Entity or for the Secondary Routing Entity; if the same AVP is selected, an error message appears. If Primary AVP is not selected for the Primary Routing Entity, an error message appears.	Format: Pulldown list Will be used for extracting the Routing Entity address. Range of User Identity routing entity types include: <ul style="list-style-type: none"> • Public Identity • ServiceInfo.Subscription-Id(0) • ServiceInfo.Subscription-Id(1) • ServiceInfo.Subscription-Id(2) • ServiceInfo.Subscription-Id(3) • Subscription-Id(0) • Subscription-Id(1) • Subscription-Id(2) • Subscription-Id(3) • UserIdentity.MSISDN • UserIdentity.Public-Identity • UserName • Wildcarded-Public-Identity
Secondary AVP	Secondary AVP used for extracting the Routing Entity address. The same Primary AVP and Secondary AVP cannot be selected for either the Primary Routing Entity or for the Secondary Routing Entity; if the same AVP is selected, an error message appears.	
Destination Type	Type of Destination for this Routing Entity Type.	Format: Pulldown list Range: <ul style="list-style-type: none"> • IMS-HSS • LTE-HSS • PCRF

Field	Description	Data Input Notes
		<ul style="list-style-type: none"> • OCS • OFCS • AAA • USERDEF1 • USERDEF2
Prefix Search Enabled	Enables the IMSI/MSISDN prefix based lookup to be performed if the full address lookup did not find a match.	Format: Radio box
Blacklist Search Enabled	Enables the IMSI/MSISDN blacklist lookup to be performed prior to the full address lookup.	Format: Radio box

Viewing Address Resolutions

Use this task to view currently configured Address Resolutions.

Select **FABR > Configuration > Address Resolutions**.

The **FABR > Configuration > Address Resolutions** page appears. This list of Address Resolutions can be filtered to display only desired records.

Inserting an Address Resolution

Use this task to add a new Address Resolution.

Before this task is performed, make sure there is at least one supported Diameter Application configured in the system.

1. Select **FABR > Configuration > Address Resolutions**.
The **FABR > Configuration > Address Resolutions** page appears.
2. Click **Insert**.
The **FABR > Configuration > Address Resolutions [Insert]** page appears.
3. Select an application ID from the **Application ID** pulldown list.
Note: The Application IDs presented in this list are those created using **Main Menu > FABR > Configuration > Applications**.
4. Select the appropriate Command Code from the **Command Code** pulldown list.
Note: The Command Codes presented in this list are those created using **Main Menu > Diameter > Command Codes**.
5. For the Primary Routing Entity section, perform the following:
 - a) Select the appropriate Routing Entity type from the **Routing Entity** pulldown list.
 - b) Select the Primary AVP from the **Primary AVP** pulldown list.
 - c) If needed, select the Secondary AVP from the **Secondary AVP** pulldown list.
 - d) Select the type of destination from the **Destination Type** pulldown list.
6. If needed, for the Secondary Routing Entity section, perform the following:
 - a) Select the appropriate Routing Entity type from the **Routing Entity Type** pulldown list.
 - b) Select the Primary AVP from the **Primary AVP** pulldown list.

- c) If needed, select the Secondary AVP from the **Secondary AVP** pulldown list.
 - d) Select the type of destination from the **Destination Type** pulldown list.
7. Perform one of the following actions:
- Click **OK** to save the address resolution and return to the **FABR > Configuration > Address Resolutions** page.
 - **Apply** to save the address resolution and stay on this page.
 - Click **Cancel** to return to the **FABR > Configuration > Address Resolutions** page without saving the data.

If **OK** or **Apply** is clicked and any of the following conditions exist, an error message appears:

- The combination of **Application ID** and **Command Code Value** is not unique; it already exists in the system
- The entry in any field is not valid (wrong data type or out of the valid range)
- Any required field is empty
- An **Address Resolution** with the **Primary Routing Entity** missing **Routing Entity**, **Primary AVP**, or **Destination Type**.
- Duplicate Routing Entity Types were selected in the **Primary** and **Secondary** Routing Entity sections
- Duplicate AVPs were selected in the **Primary AVP** and **Secondary AVP** fields
- The maximum number of Address Resolutions (128) is already defined in the system

Editing an Address Resolution

Use this task to edit an Address Resolution.

1. Select **FABR > Configuration > Address Resolution**.
The **FABR > Configuration > Address Resolutions** page appears.
2. Select the Address Resolution you want to edit, then click **Edit**.
The **FABR > Configuration > Address Resolutions [Edit]** page appears.
Note: An error message appears if the Address Resolution has already been removed.
3. Update the relevant fields.
For more information about each field, see [Address Resolutions configuration elements](#).
The following fields are read-only and cannot be edited:

- **Application ID**
- **Command Code**

4. Perform one of the following actions:
 - Click **OK** to save the changes and return to the **FABR > Configuration > Address Resolutions** page.
 - Click **Apply** to save the changes and stay on this page.
 - Click **Cancel** to return to the **FABR > Configuration > Address Resolutions** page without saving the changes.

If **OK** or **Apply** is clicked and any of the following conditions exist, an error message appears:

- The entry in any field is not valid (wrong data type or out of the valid range)

- Any required field is empty
- An **Address Resolution** with the **Primary Routing Entity** missing **Routing Entity**, **Primary AVP**, or **Destination Type**.
- Duplicate Routing Entity Types were selected in the **Primary** and **Secondary** Routing Entity sections
- Duplicate AVPs were selected in the **Primary AVP** and **Secondary AVP** fields

Deleting an Address Resolution

Use this task to delete an Address Resolution.

1. Select **FABR > Configuration > Address Resolutions**.
The **FABR > Configuration > Address Resolutions** page appears.
2. Select the Address Resolution you want to delete, then click **Delete**.
A popup window appears.

Note: An error message appears if the Address Resolution has already been removed.

3. Perform one of the following actions:
 - Click **OK** to delete the Address Resolution.
 - Click **Cancel** to cancel the delete function and return to the **FABR > Configuration > Address Resolutions** page.

System Options configuration

The **System Options** page allows you to modify the default system values for FABR global parameters, for example, FQDN/Realm, Allow Subsequent FABR Invocation, or Application Unavailable action.

System Options elements

Table 11: System Options Elements describes the fields on the System Options page.

Table 11: System Options Elements

Field	Description	Data Input Notes
ASCII Excluded Digits	List of ASCII characters to ignore while parsing MSISDN digits from a raw AVP data field of AVP Type UTF8String. If an invalid character is entered, an error message appears.	Format: Text boxes Default = n/a Range = ASCII printable characters except '%', '@', ':' and ';'.
Exclude Space	Defines whether ASCII character space is ignored while parsing MSISDN digits from a raw AVP data field of AVP Type UTF8String If checked, ASCII character space is ignored.	Format: Check box Range: Checked, unchecked Default: Unchecked

Field	Description	Data Input Notes
	If not checked, ASCII character space is not ignored.	
TBCD Excluded Digits	Defines whether the associated digits is ignored while parsing digits from a raw AVP data field of AVP Type OctetString encoded as a TBCD-string If checked, digits is ignored. If not checked, digits is not ignored.	Format: Check boxes Range: Checked, unchecked for each option: *(1010), #(1011), a(1100), b(1101), c(1110) Default: Unchecked
Allow Subsequent FABR Invocation	Enables the subsequent invocation of FABR on a different DSR node in the network	Format: Check box Range: Checked, unchecked Default: Unchecked
Remove Destination-Host	If checked, FABR deletes any instance of "Destination-Host" AVPs in the message when performing "Realm only" resolution.	Format: Check box Range: Checked, unchecked Default: Unchecked
Realm	Value to be placed in the Origin-Realm AVP of the Answer message generated by FABR. A Realm must be paired with a Fully Qualified Domain Name. If entering a value for Realm, then a value for Fully Qualified Domain Name must also be entered; otherwise, an error message appears. If a value is not entered, the local node Realm for the egress connection is used.	Format: string consisting of a list of labels separated by dots. A label can contain letters, digits, dash (-), and underscore (_). A label must begin with a letter, digit, or underscore, and must end with a letter or digit. Underscore can be used only as the first character. Range = A valid Realm - up to 255 characters; label-up to 63 characters.
Fully Qualified Domain Name	Value to be placed in the Origin-Host AVP of the Answer message generated by FABR A Fully Qualified Domain Name must be paired with a Realm. If entering a value for Fully Qualified Domain Name, then a value for Realm must also be entered; otherwise, an error message appears.	Format: string consisting of a list of labels separated by dots. A label can contain letters, digits, dash (-), and underscore (_). A label must begin with a letter, digit, or underscore, and must

Field	Description	Data Input Notes
	If not configured, local node FQDN for the egress connection is used.	end with a letter or digit. Underscore can be used only as the first character. Range = A valid FQDN - up to 255 characters; label-up to 63 characters.
Resource Exhaustion Result-Code	Result-Code or Experimental-Result-Code value to be returned in an Answer message when a message is not successfully routed because of internal resource being exhausted If Vendor-Id is configured, this result-code value is encoded as Experimental-Result-Code AVP; otherwise the result-code is encoded as Result-Code AVP.	Format: <ul style="list-style-type: none"> • Selection text box; numeric • Selection pulldown list Range: <ul style="list-style-type: none"> • Selection box: 1000–5999 • Pulldown list: available Code values Default: 3004
Resource Exhaustion Error Message	Error-Message AVP value to be returned in an Answer message when a message is not successfully routed because of internal resource being exhausted	Range: 0–64 characters Default: FABR Resource Exhausted
Resource Exhaustion Vendor-Id	Vendor-Id AVP value to be returned in an Answer message when a message is not successfully routed because of internal resource being exhausted	Format: Text box; numeric Range: 1–4294967295
Application Unavailable Action	Defines action to be taken when FABR is not available to process messages If the Default Route option is selected, an entry must be provided for the Application Unavailable Route List.	Format: Radio buttons Range: <ul style="list-style-type: none"> • Continue Routing • Default Route • Send Answer with Result-Code AVP • Send Answer with Experimental-Result AVP Default: Continue Routing

Field	Description	Data Input Notes
Application Unavailable Route List	<p>Defines where the requests will be routed when FABR is not available. Peer Routing Rules will be bypassed.</p> <p>A route list must be entered if Default Route is selected as the Application Unavailable Action.</p>	<p>Format: Pulldown list</p> <p>Range: Available Route List entries</p>
Application Unavailable Result-Code	<p>Result-Code or Experimental-Result-Code value to be returned in an Answer message when a message is not successfully routed because FABR is not available.</p> <p>If Vendor-Id is configured, this result-code value is encoded as Experimental-Result-Code AVP; otherwise the result-code is encoded as Result-Code AVP.</p> <p>A code must be entered if either the Send Answer with Result-Code AVP or the Send Answer with Experimental Result-Code AVP option is selected as the Application Unavailable Action.</p>	<p>Format:</p> <ul style="list-style-type: none"> • Selection Text box; numeric • Selection pulldown list <p>Range:</p> <ul style="list-style-type: none"> • Selection box: 1000–5999 • Pulldown list: available Code values <p>Default: 3002</p>
Application Unavailable Error Message	<p>Error-Message AVP value to be returned in an Answer message when a message is not successfully routed because FABR is not available.</p> <p>A message can be entered, if needed, when either the Send Answer with Result-Code AVP or the Send Answer with Experimental Result-Code AVP option is selected as the Application Unavailable Action.</p>	<p>Range: 0–64 characters</p> <p>Default: FABR Unavailable</p>
Application Unavailable Vendor-Id	<p>Vendor-Id AVP value to be returned in an Answer message when a message is not successfully routed because FABR is not available.</p> <p>A vendor-Id must be entered if the Send Answer with Experimental Result-Code AVP option is selected as the Application Unavailable Action.</p>	<p>Format: Text box; numeric</p> <p>Range: 1–4294967295</p>
Bundling Enabled	<p>If enabled, allows FABR to bundle DP query Events to form a DP Bundled query Event to send to DP Server.</p>	<p>Format: Check box</p>
Maximum Bundle Size	<p>Maximum number of individual DP query Events that can be bundled.</p>	<p>Format: Text box; numeric</p> <p>Range: 2-20</p> <p>Default: 5</p>

Field	Description	Data Input Notes
Prefix Search Enabled	If enabled, IMSI/MSISDN prefix based lookup is performed if the full address lookup did not find a match.	Format: Check box
Blacklist Search Enabled	If enabled, IMSI/MSISDN blacklist lookup is performed prior to the full address lookup.	Format: Check box

Editing System Options

Use this task to edit System Options.

1. Select **FABR > Configuration > System Options**.
The **FABR > Configuration > System Options** page appears.
2. Update the relevant fields.
For more information about each field, see [System Options elements](#).
3. Perform one of the following actions:
 - Click **Apply** to save the changes and stay on this page.
 - Click **Cancel** to return to the **FABR > Configuration > System Options** page without saving the changes.

If **Apply** is clicked and any of the following conditions exist, an error message appears:

 - Either the **Realm** or **Fully Qualified Domain Name** is empty; no value was entered; these fields must be configured as a pair
 - Any required field is empty; no value was entered
 - The entry in any field is not valid (wrong data type or out of the valid range)

Post-Configuration Activities

After FABR configuration is complete, the following activities need to be performed to make FABR fully operational in the system:

- Enabling the FABR application, if it has not already been enabled.
- Status Verification

Enabling the FABR Application

Use this task to enable the FABR application.

1. From each active SOAM in a 3-tiered DSR topology, select **Diameter > Maintenance > Applications**.
The **Diameter > Maintenance > Applications** page appears.
2. Under **DSR Application Name**, select each **FABR** row.
To select more than one row, press and hold **Ctrl** while you click each row.
3. Click **Enable**.

4. Verify the application status on the page.

The **Admin State**, **Operational Status**, **Operational Reason**, and **Congestion Level** in each of the selected rows should have changed respectively to **Enabled**, **Available**, **Normal**, and **Normal**.

Status Verification

Use this task to verify FABR status after configuration is complete.

1. Verify Communication Agent (ComAgent) Connection status.
 - a) From the active SOAM in a 3-tiered DSR topology, select **Communication Agent > Maintenance > Connection Status**.
 - b) Verify that the **Automatic Connections Count** field displays **X of X in service** where X is the number of peer server connections.
2. Verify Server status.
 - a) From the active SOAM in a 3-tiered DSR topology, select **Status & Manage > Server**.
 - b) Verify that for each Server, the **Appl State** field is **Enabled**, and the **DB**, **Reporting Status**, and **Proc** fields are **Norm**.

DSR Bulk Import and Export

The following documents describe the use and operation of DSR Bulk Import and Export functions:

- *Diameter Common User's Guide*,
- **Help > Diameter Common > DSR Bulk Import**
- **Help > Diameter Common > DSR Bulk Export**

The DSR Bulk Import and Export functions can be used to export Diameter, IPFE, and DSR Application configuration data in CSV files to a location outside the system, and to import the files (usually edited) into the system where the Import function is executed.

Configuration data refers to any data that is configured for one of the Export **Export Application** types (FABR, RBAR, PDRA, GLA, MAPIWF, or CPA and SBR DSR Applications; IPFE; and the Diameter components). "Diameter" includes Diameter Configuration components and Diameter Common Network Identifiers and MPs components.

DSR Bulk Export

The DSR Bulk Export operation creates ASCII Comma-Separated Values (CSV) files (.csv) containing Diameter, IPFE, and DSR Application configuration data. Exported configuration data can be edited and used with the DSR Bulk Import operations to change the configuration data in the local system without the use of GUI pages. The exported files can be transferred to and used to configure another DSR system.

Each exported CSV file contains one or more records for the configuration data that was selected for the Export operation. The selected configuration data can be exported once immediately, or exports can be scheduled to periodically occur automatically at configured times.

The following configuration data can be exported in one Export operation:

- All exportable configuration data in the system

- All exportable configuration data from the selected DSR Application, IPFE, or Diameter (each component's data is in a separate file)
- Exportable configuration data from a selected configuration component for the selected DSR Application, IPFE, or Diameter

Exported files can be written to the File Management Directory in the local File Management area (**Status & Manage > File** page), or to the Export Server Directory for transfer to a configured remote Export Server.

CSV files that are in the local File Management area can be used for Bulk Import operations on the local system.

If the export has any failures or is unsuccessful, the results of the export operation are logged to a log file with the same name as the exported file but with a ".log" extension. Successful export operations will not be logged.

DSR Bulk Import

The DSR Bulk Import operations use configuration data in ASCII Comma-Separated Values (CSV) files (.csv), to insert new data into, update existing data in, or delete existing data from the configuration data in the system.

Note: Some configuration data can be imported only with the Update operation, and other data can be imported with Insert and Delete operations but not Update. Refer to the "DSR Bulk Import" section of the *Diameter Common User's Guide* or the **Diameter Common > Import** Help for valid Import operations.

Import CSV files can be created by using a DSR Bulk Export operation, or can be manually created using a text editor.

Note: The format of each Import CSV file record must be compatible with the configuration data in the DSR release that is used to import the file.

Files that are created using the DSR Bulk Export operation can be exported either to the local Status & Manage File Management Directory (**Status & Manage > Files** page), or to the local Export Server Directory.

CSV files that are in the local File Management area can be used for Bulk Import operations on the local system.

Files can be created manually using a text editor on a computer; the files must be uploaded to the File Management area of the local system before they can be used for Import operations on the local system.

The following Import operations can be performed:

- Insert new configuration data records that do not currently exist in the system
- Update existing configuration data in the system
- Delete existing configuration data from the system

Each Import operation creates a log file. If errors occur, a Failures CSV file is created that appears in the File Management area. Failures files can be downloaded, edited to correct the errors, and imported to successfully process the records that failed. Failures files that are unchanged for more than 14 days and log files that are older than 14 days are automatically deleted from the File Management area.

Chapter 4

Maintenance

Topics:

- [Overview.....48](#)
- [FABR Administrative State and Operational Status.....48](#)

This section describes maintenance functions and information that can be used with the FABR application.

Overview

The FABR application has no maintenance GUI pages of its own. The following Diameter > Maintenance GUI pages provide functions and information that can be used with the FABR application:

- The **Diameter > Maintenance > Applications** page displays FABR status information including Admin State, Operational Status, and Operational Reason. The page also provides functions to enable and disable the application. See [FABR Administrative State and Operational Status](#) and refer to the *Diameter User Guide* and Help for explanations of the page and the status information.
- The **Diameter > Maintenance > DA-MPs** page displays status and connectivity information for the DA-MP that is running the FABR application. Refer to the *Diameter User Guide* and Help for explanations of the page and the status information.

FABR Administrative State and Operational Status

The FABR application has an Administrative State and an Operational Status. The Administrative State (or Admin State) indicates the state that the operator desires the FABR application to be in, and can be manually enabled or disabled. The Operational Status indicates the actual status of the FABR application. The FABR Admin State and Operational Status will be updated when the application is started or restarted and when FABR congestion is detected.

[Table 12: FABR Admin State and Operational Status](#) lists the FABR Admin State and Operational Status related to the DP pool operational status and to FABR congestion levels. It specifies the actions that FABR will take in various situations.

Table 12: FABR Admin State and Operational Status

FABR Admin State	DP Operational Status/Congestion Level	FABR Congestion Level	FABR Operational Status	FABR Actions or Impacts on FABR
Disabled	Any	Any	Unavailable	The default shutdown state
Enabled	DP Operational Status = Normal OR Degraded/ DP Congestion Level = Normal OR Minor	Normal	Available	FABR receives Requests from the Diameter Routing Function normally FABR sends queries to the DP normally
	DP Operational Status = Normal OR Degraded/ DP Congestion Level = Major OR	Normal	Available	FABR receives Requests from the Diameter Routing Function normally

Critical OR DP Congestion Abatement in progress			FABR applies DP Congestion routing exception action
DP Operational Status = Normal OR Degraded/ DP Congestion Level = Any	CL1 or CL2	Degraded	The Diameter Routing Function stops sending Requests to FABR
	CL3	Unavailable	The Diameter Routing Function stops sending Requests to FABR
DP Operational Status = Down/ DP Congestion Level = Any	Any	Unavailable	The Diameter Routing Function stops sending Requests to FABR

A

AAA	Authentication, Authorization, and Accounting (Rx Diameter command)
ASCII	American Standard Code for Information Interchange
AVP	Attribute-Value Pair The Diameter protocol consists of a header followed by one or more attribute-value pairs (AVPs). An AVP includes a header and is used to encapsulate protocol-specific data (e.g., routing information) as well as authentication, authorization or accounting information.

B

Blacklist	Provisioning Blacklist. An indication that a call from the calling party is not valid.
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C

Communication Agent	See ComAgent.
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D

DP	Data Processor The repository of subscriber data on the individual DSR node elements. The DP hosts the full address resolution database.
DSR	Diameter Signaling Router

D

A set of co-located Message Processors which share common Diameter routing tables and are supported by a pair of OAM servers. A DSR Network Element may consist of one or more Diameter nodes.

F

FABR

Full Address Based Resolution

Provides an enhanced DSR routing capability to enable network operators to resolve the designated Diameter server addresses based on individual user identity addresses in the incoming Diameter request messages.

Full Address Based Resolution

See FABR.

G

GUI

Graphical User Interface

The term given to that set of items and facilities which provide the user with a graphic means for manipulating screen data rather than being limited to character based commands.

H

HSS

Home Subscriber Server

A central database for subscriber information.

I

IANA

Internet Assigned Numbers Authority

An organization that provides criteria regarding registration of values related to the Diameter protocol.

I

IMPI	IP Multimedia Private Identity
IMPU	IP Multimedia Public Identity
IMS	IP Multimedia Subsystem These are central integration platforms for controlling mobile communications services, customer management and accounting for mobile communications services based on IP. The IMS concept is supported by 3GPP and the UMTS Forum and is designed to provide a wide range of application scenarios for individual and group communication.
IMSI	International Mobile Subscriber Identity International Mobile Station Identity

L

LTE	Long Term Evolution The next-generation network beyond 3G. In addition to enabling fixed to mobile migrations of Internet applications such as Voice over IP (VoIP), video streaming, music downloading, mobile TV, and many others, LTE networks will also provide the capacity to support an explosion in demand for connectivity from a new generation of consumer devices tailored to those new mobile applications.
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M

MSISDN	The MSISDN is the network specific subscriber number of a
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M

mobile communications subscriber. This is normally the phone number that is used to reach the subscriber.

Mobile Subscriber Integrated Services Digital Network [Number]

Mobile Station International Subscriber Directory Number. The unique, network-specific subscriber number of a mobile communications subscriber.

MSISDN follows the E.164 numbering plan; that is, normally the MSISDN is the phone number that is used to reach the subscriber.

N

NOAM

Network Operations, Administration, and Maintenance

O

OCS

Online Charging Server

OFCS

Offline Charging Server

P

PCRF

Policy and Charging Rules Function. The ability to dynamically control access, services, network capacity, and charges in a network.

Maintains rules regarding a subscriber's use of network resources. Responds to CCR and AAR messages. Periodically sends RAR messages. All policy sessions for a given subscriber, originating anywhere in the network, must be processed by the same PCRF.

R

Relay Agent

Diameter agent that forwards requests and responses to other

R

Diameter nodes based on routing-related AVPs (such as Destination-Realm) and routing configuration. Because relays do not make policy decisions, they do not examine or alter non-routing AVPs. As a result, relays never originate messages, do not need to understand the semantics of messages or non-routing AVPs, and are capable of handling any Diameter application or message type.

S

SDS

Subscriber Database Server

Subscriber Database Server (SDS) provides the central provisioning of the Full-Address Based Resolution (FABR) data. The SDS, which is deployed geo-redundantly at a Primary and Disaster recovery site, connects with the Query Server and the Data Processor System Operations, Administration, and Maintenance (DP SOAM) servers at each Diameter Signaling Router (DSR) site or a standalone DP site to replicate and recover provisioned data to the associated components.

SOAM

System Operations,
Administration, and Maintenance
Site Operations, Administration,
and Maintenance

Subscriber Database Server

See SDS.

T

TBCD

Telephony Binary Coded Decimal
An expansion to BCD where the
remaining (unused) bit

T

combinations are used to add specific telephony characters. It is backward compatible to BCD.